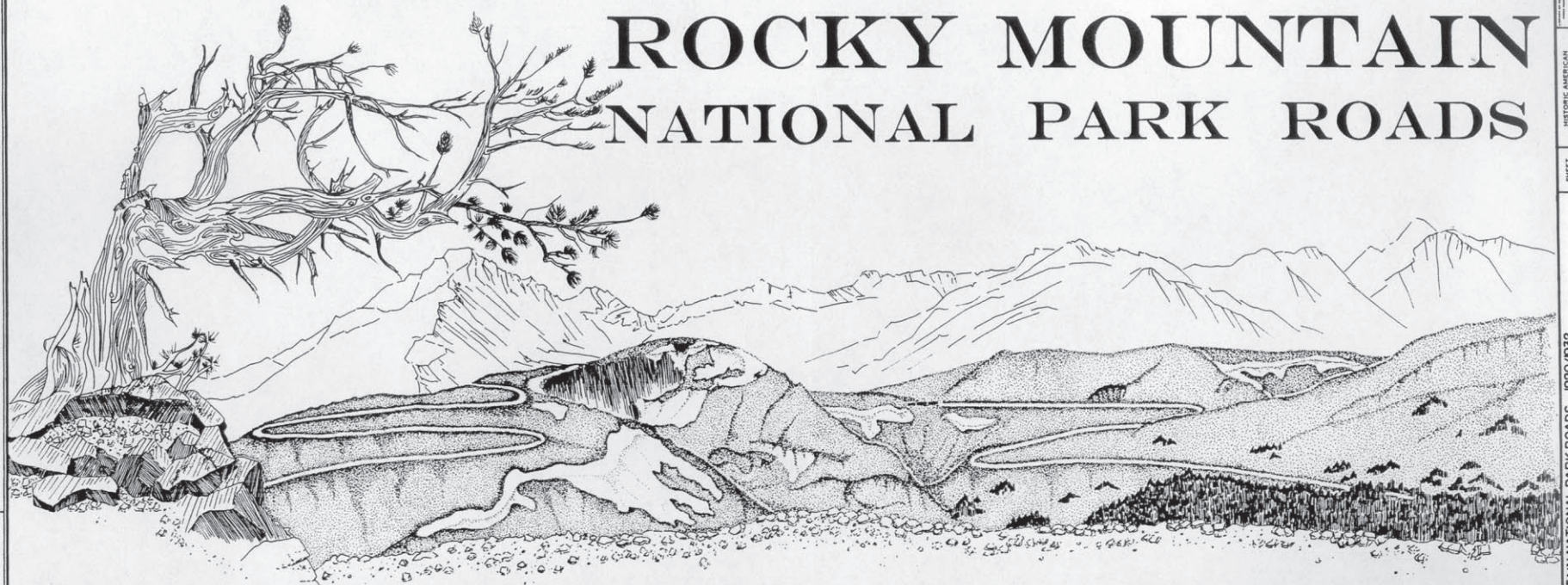


# ROCKY MOUNTAIN NATIONAL PARK ROADS



The road system of Rocky Mountain National Park offers visitors access to diverse ecosystems characterizing the higher regions of the central Rocky Mountains. The roads take visitors through lowland meadows and aspen groves, along swift-flowing rivers and up through subalpine forest to more than 12,000' in elevation. No other national park roads offers the dramatic experience of a long drive across the tundra region, and few offer such a wide variety of experiences. The careful relationship of the park roads to the landscape results in a road system that generally harmonizes with the environment. Roadway alignments were chosen to highlight natural features, and scenic vistas and overlooks were provided to allow visitors to take in the magnificent terrain. The stone parapet walls and road-related structures, constructed in the National Park Service's distinctive "rustic style" of architecture, relate well to their natural surroundings and help evoke a distinctive "national park road" experience. Not surprisingly, the park roads are the principal attraction for most of the nearly three million visitors who flock to Rocky Mountain National Park each year.

American explorers had considered the Rocky Mountains impenetrable, but native peoples of the Ute and Arapahoe tribes had long passed back and forth over the range; the two park roads now crossing the mountains follow their general routes.

The first to cross the mountains was the Fall River Road, constructed by the State of Colorado and Larimer and Grand counties to encourage tourism. Built between 1913 and 1920, this narrow unpaved single-lane road climbed up the deep Fall River Valley to Fall River Pass, then dropped down a series of sharp switchbacks to the Colorado River in the Kawuneechee Valley. This road proved difficult for early automobiles to traverse, and clearing the shaded route of snow each year was a difficult and dangerous undertaking. Soon after it was completed, the park began planning a replacement.



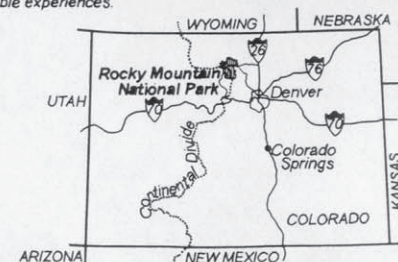
The Rocky Mountain National Park Roads Recording Project was undertaken during the summer of 2000 and is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER (Eric DeLony, Chief) is administered by the Historic American Buildings Survey/Historic American Engineering Record (E. Blaine Cliver, Chief), a division of the National Park Service, U.S. Department of the Interior. The project was funded by the U.S. Department of Transportation's Federal Lands Highway Program (Art Hamilton, Administrator) through the NPS Park Roads and Parkways Program (Lou DeLorme, Manager) and cosponsored by Rocky Mountain National Park (Randy Jones, Superintendent) and the NPS Cooperative Program at Montana State University (Barry Sulam, Manager).

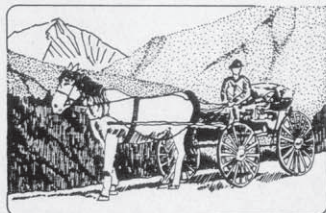
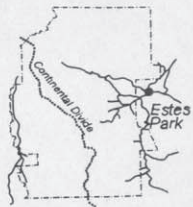
The field work, measured drawings, and historical reports were completed under the direction of Todd A. Croteau, Project Leader; and Tim Davis, Program Historian. The recording team consisted of Field Supervisor Brandy Dubs (Montana State University); Architects Arin Streeter (University of Tennessee), Eszter Vogel (US/ICOMOS, Hungary), Lucas Dupuis and Nathan Junkert (Montana State University), Christopher Boldt (University of Washington); Landscape Architect Magdalena M. Lisowska (US/ICOMOS, Poland); and Historian Richard Quin.

The new Trail Ridge Road, constructed between 1926 and 1932, climbed nearly a thousand feet higher but crossed the more open terrain of Trail Ridge. This two-lane roadway was carefully designed to avoid damage to the fragile alpine scenery it crossed. Reaching 12,183' on Trail Ridge, it is the highest continuous highway in the United States.

The roads in the Bear Lake, Moraine Park, Lily Lake and Wild Basin areas were built as county or private roads to small holdings predating the establishment of the park in 1915; today, all are under park maintenance.

The road system of Rocky Mountain National Park continues to provide visitors with access to most majestic scenery. The roads wind through deep forest glades and across the open treeless tundra, providing glimpses of boldly colored wildflowers and magnificent wild animals. Even today, decades after they were built, excursions along these remarkable roads provide memorable experiences.





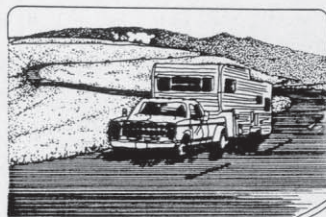
Road System and transportation before 1917

In its earliest years, Rocky Mountain National Park transportation system was limited to short spur roads leading into areas along the park's periphery. The first tourist road, the "Highdrive," was a scenic loop that climbed from Estes Park to Deer Ridge. These dirt and gravel roads were used by wagons, early automobiles, and commercial "jitneys."



Road System and transportation after 1920

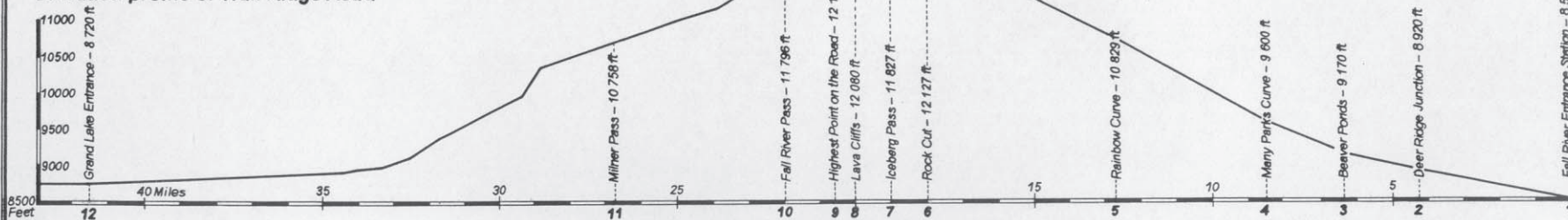
With the opening of the Fall River Road in 1920, motorists could cross the Continental Divide and reach the interior of the park. The road was popular but expensive to maintain and difficult for early automobiles to traverse on account of its steep grades. Sharp curves posed problems for larger vehicles and buses, while heavy snows kept the road closed late into the tourism season.



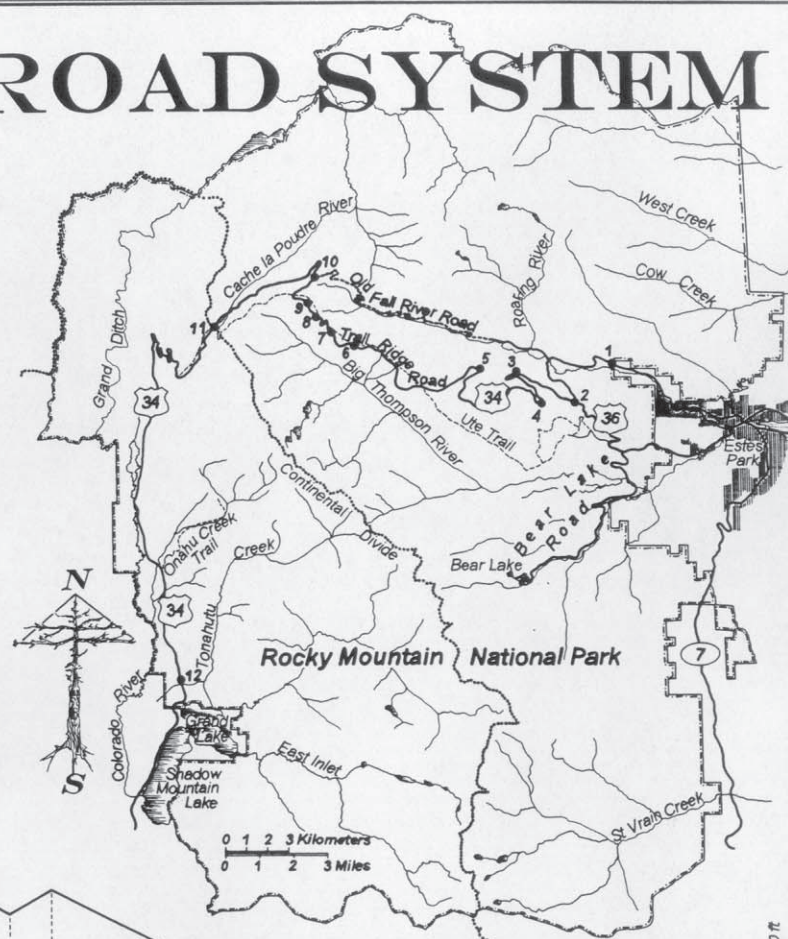
Road System and transportation from 1932

Trail Ridge Road was planned to alleviate these shortcomings. It offered moderate grades, wider-radius curves, fewer places of heavy snow accumulation, and panoramic views. Today, more than a million visitors a year take advantage of the park roads to experience the park's incomparable beauty, utilizing everything from bicycles to tour buses and recreational vehicles.

Elevation profile of Trail Ridge Road



# ROAD SYSTEM

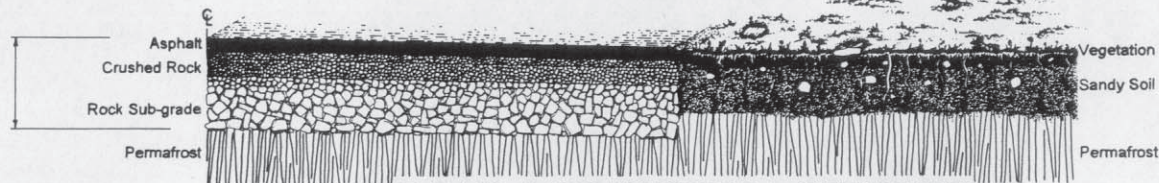
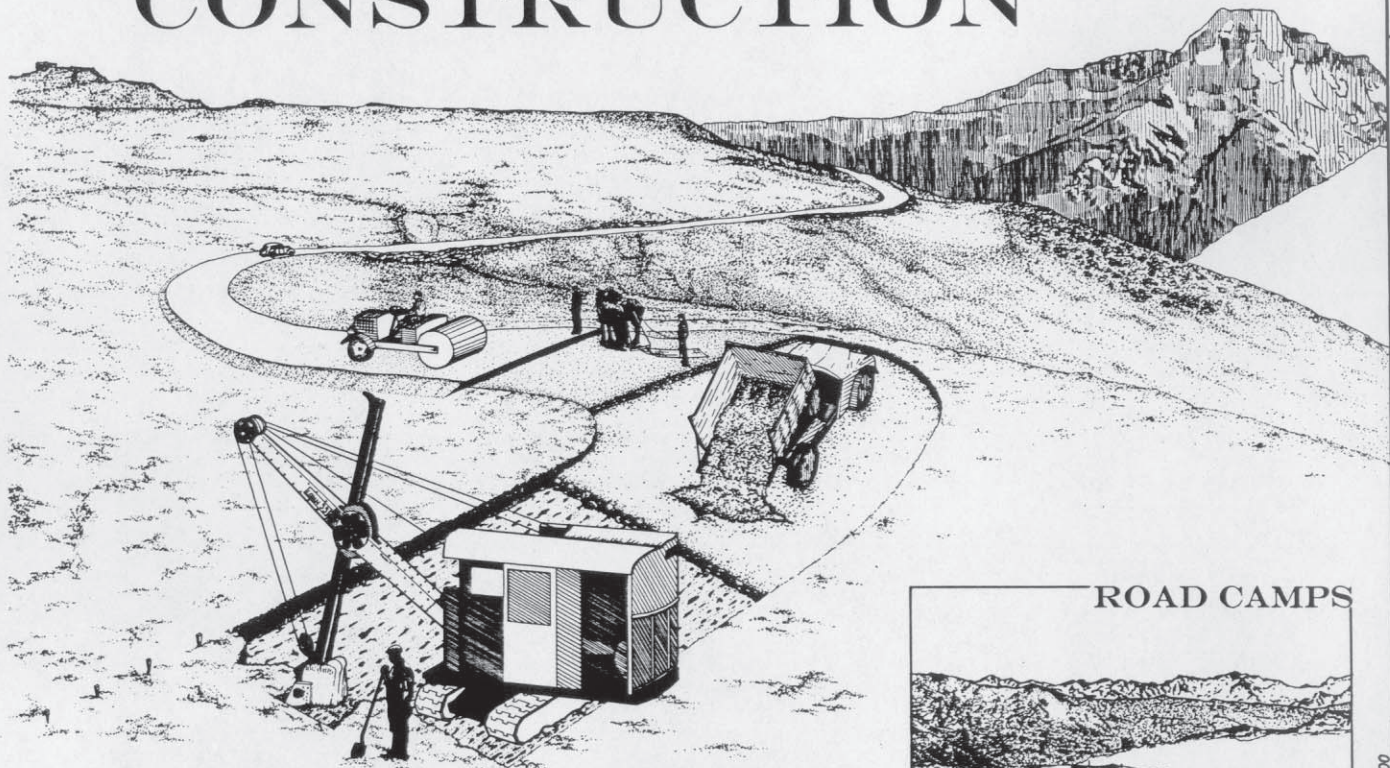


# HIGH-ALTITUDE CONSTRUCTION

More than eight miles of Trail Ridge Road lie at least 11,000' above sea level; three miles are above 12,000'. Above treeline, the road crosses an open tundra landscape underlain by perpetually frozen soil called permafrost usually only encountered north of the Arctic Circle. In contrast to the tortuous climb up from the valleys below, the high elevation sections were designed with easy slopes and gentle curves sweeping across the landscape, offering spectacular views down Forest Canyon and the Fall River Valley. Close at hand on either side are many of the highest peaks of the northern Rockies.

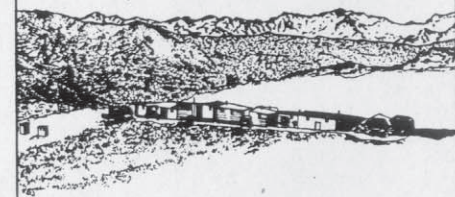
Construction of the road through this harsh and ecologically sensitive landscape presented challenges rarely encountered in traditional roadway construction. Construction crews working in this section were routinely confronted by harsh weather conditions. Road-obliterating landslides and heavy snowdrifts hampered the work. Violent electrical storms and hurricane-force winds often forced crews down the mountain. Freezing temperatures and blinding snowstorms could occur at any time, even in the summer months. Compounding these problems was the lack of oxygen at the higher altitudes, making the hard work even more difficult.

One of the greatest challenges was constructing the roadway across the alpine tundra and permafrost, an extremely delicate ecosystem that develops at a rate of about an inch every hundred years. Normal drills would not penetrate the frozen material, and special equipment had to be designed. The thinner areas could be stripped away like sod or melted by exposure, but where it was deep, disturbance had to be minimized. The deeper parts below the surface could not be allowed to melt, or the area would turn into a permanent quagmire. Here the upper sections were carefully removed, then a prepared roadbed was constructed on rock fill resting directly atop the frozen soil. The tundra sod that had been salvaged was then used to cover the roadbanks scarred during construction.



ROAD AND TUNDRA SECTION

## ROAD CAMPS



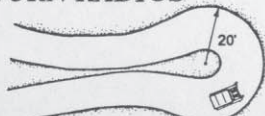
To avoid further scarring the tundra, rolling road camps were located right on the road. This kept the crews close to the work sites and off the fragile vegetation.

## GRADE



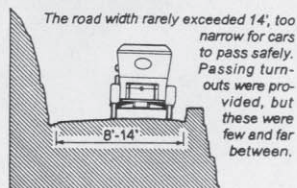
The road climbed to Fall River Pass on steep grades sometimes reaching 16%. Some early automobiles had to climb in reverse due to their weak engines and gravity-fed fuel systems. Surfacing materials washed off quickly.

## TURN RADIUS

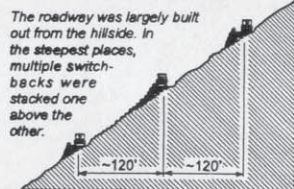


Motorists had to negotiate sixteen switchbacks with radii as tight as 20'. Some vehicles had to turn back and forth repeatedly to make the curves.

## ROAD WIDTH



## ELEVATION GAIN



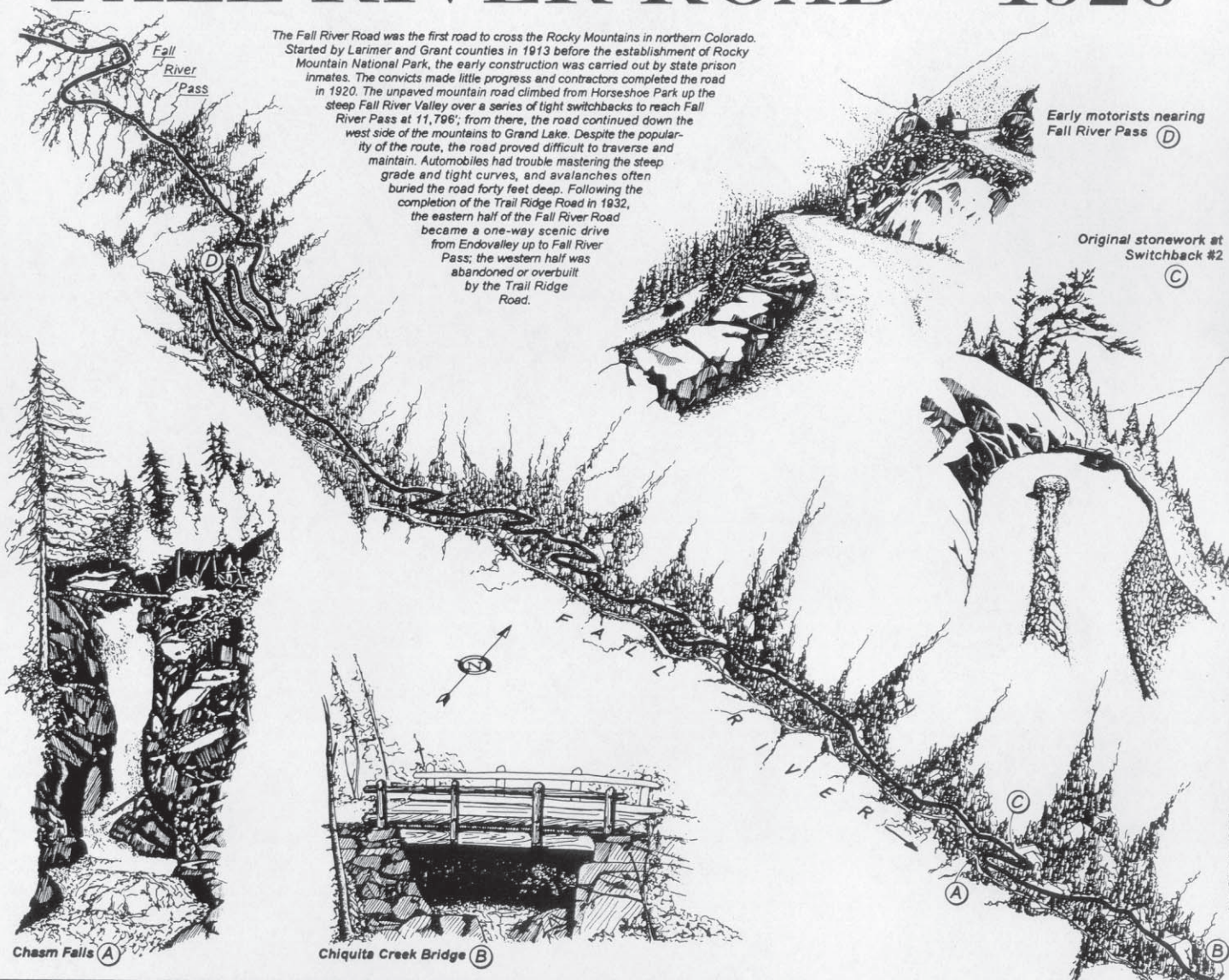
## PULLOUTS



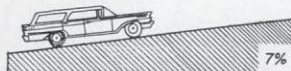
Few pullouts were provided to allow motorists to stop; some were located on switchbacks, making the curves even more difficult.

# FALL RIVER ROAD - 1920

The Fall River Road was the first road to cross the Rocky Mountains in northern Colorado. Started by Larimer and Grant counties in 1913 before the establishment of Rocky Mountain National Park, the early construction was carried out by state prison inmates. The convicts made little progress and contractors completed the road in 1920. The unpaved mountain road climbed from Horseshoe Park up the steep Fall River Valley over a series of tight switchbacks to reach Fall River Pass at 11,796'; from there, the road continued down the west side of the mountains to Grand Lake. Despite the popularity of the route, the road proved difficult to traverse and maintain. Automobiles had trouble mastering the steep grade and tight curves, and avalanches often buried the road forty feet deep. Following the completion of the Trail Ridge Road in 1932, the eastern half of the Fall River Road became a one-way scenic drive from Endovalley up to Fall River Pass; the western half was abandoned or overbuilt by the Trail Ridge Road.



## GRADE



The road was designed with a ruling grade generally less than 5% and never exceeding 7%, less than half as steep as the Fall River Road.

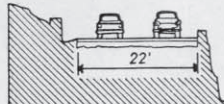
## TURN RADIUS



Minimum radii for open curves was 100', and 200' on blind curves. Many curves were designed to sweep across but not dominate, the landscape.

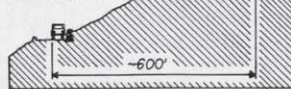
## ROAD WIDTH

Unlike the single-track Fall River Road, Trail Ridge Road was designed as a two-lane with a 22' roadbed and 3' ditches in cut sections.



## ELEVATION GAIN

The roadway was largely built into the hillside, elevated on rock fill once it reached the tundra. Long continuous curves were used to gain elevation.



## PULLOUTS



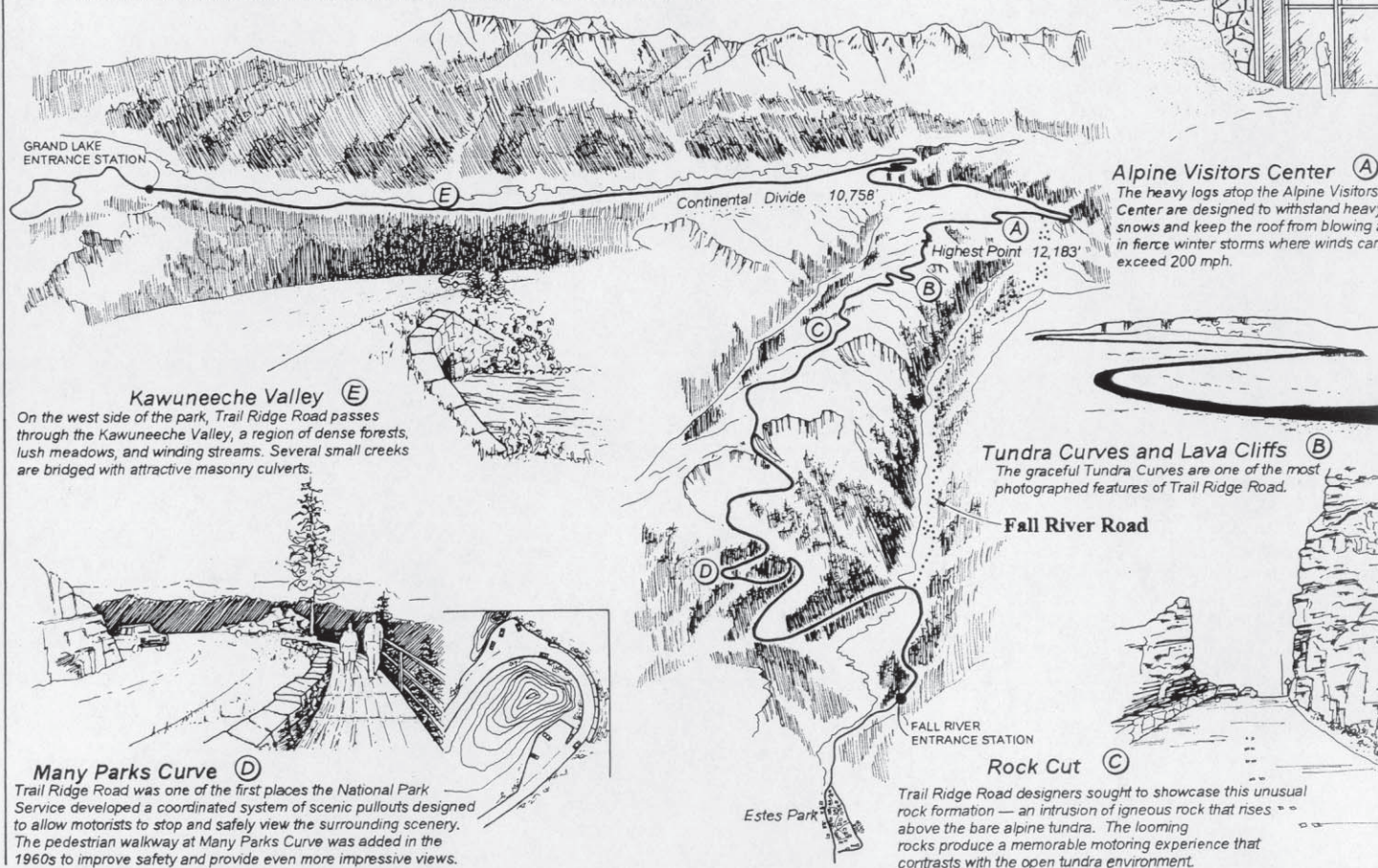
The commodious stone-walled turnouts, often located on major curves, provided ample space for visitors to take in the views.

# TRAIL RIDGE ROAD - 1932

Trail Ridge Road provides spectacular views of the majestic scenery of Rocky Mountain National Park. It is the highest continuous motorway in the United States, with more than eight miles lying above 11,000' and a maximum elevation of 12,183'. The name "Trail Ridge Road" derives from its proximity to historic pathways used by native peoples to cross the Rocky Mountains.

Trail Ridge Road was designed to replace the Fall River Road, which proved inadequate for modern motor travel as soon as it opened in 1920. Trail Ridge Road was designed to have more gentle grades, broader curves, and a greater variety of scenic experiences. The sunny, ridge-top location would also reduce snow accumulation and allow Trail Ridge Road to open earlier than its shady, snow-laden predecessor.

Trail Ridge Road was constructed between 1926 and 1932 through the collaborative efforts of the National Park Service and the Bureau of Public Roads (now the Federal Highway Administration). Construction crews had to contend with imposing terrain, harsh weather, short working seasons, and stringent design criteria, which were intended to ensure that the road would "lie lightly on the land," displaying the region's rich scenic diversity with minimal impact on the natural environment. Trail Ridge Road opened in July 1932, providing motorists with access to impressive views, memorable wildlife viewing opportunities, and spectacular high mountain terrain.



### Alpine Visitors Center (A)

The heavy logs atop the Alpine Visitors Center are designed to withstand heavy snows and keep the roof from blowing away in fierce winter storms where winds can exceed 200 mph.

### Tundra Curves and Lava Cliffs (B)

The graceful Tundra Curves are one of the most photographed features of Trail Ridge Road.

### Fall River Road

FALL RIVER ENTRANCE STATION

### Rock Cut (C)

Trail Ridge Road designers sought to showcase this unusual rock formation — an intrusion of igneous rock that rises above the bare alpine tundra. The looming rocks produce a memorable motoring experience that contrasts with the open tundra environment.

### Many Parks Curve (D)

Trail Ridge Road was one of the first places the National Park Service developed a coordinated system of scenic pullouts designed to allow motorists to stop and safely view the surrounding scenery. The pedestrian walkway at Many Parks Curve was added in the 1960s to improve safety and provide even more impressive views.

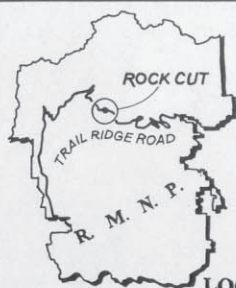
GRAND LAKE ENTRANCE STATION

Continental Divide 10,758'

Highest Point 12,183'

### Kawuneeche Valley (E)

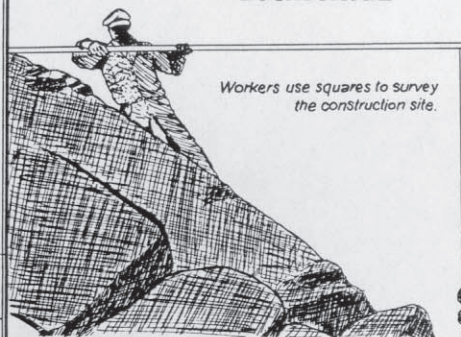
On the west side of the park, Trail Ridge Road passes through the Kawuneeche Valley, a region of dense forests, lush meadows, and winding streams. Several small creeks are bridged with attractive masonry culverts.



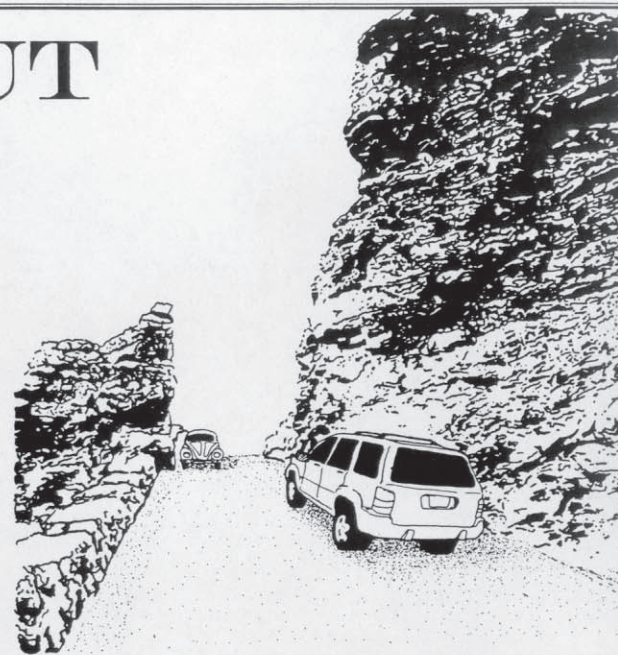
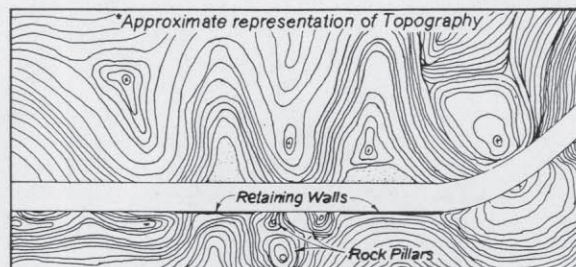
LOCATOR MAP

# THE ROCK CUT

This projecting rock formation at 12,110' elevation had to be cut through by road crews in order to allow the Trail Ridge Road to pass. The highly resistant rock was blasted away with large quantities of explosives, in one case, 178 shots (a half ton of black powder) were wired together and fired at one time. The workers took special care to preserve the surviving stone monoliths on the downslope side, wrapping them in timber to protect them from rocks hurled by the blasting. Rocks thrown beyond the construction zone were retrieved to avoid marring the landscape. A steam shovel was employed to excavate the blasted material which was crushed and used in the bench sections for surfacing. The road through the rock cut is supported on high hand-placed dry-laid stone embankments topped by crenellated parapet wall.



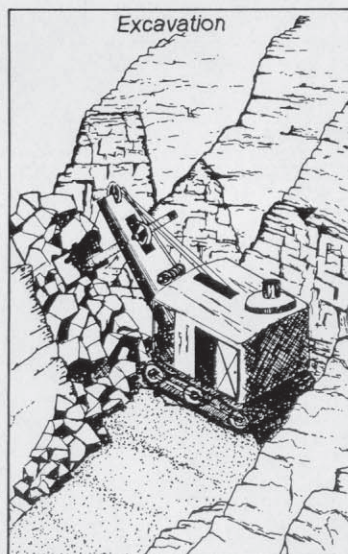
Workers use squares to survey the construction site.



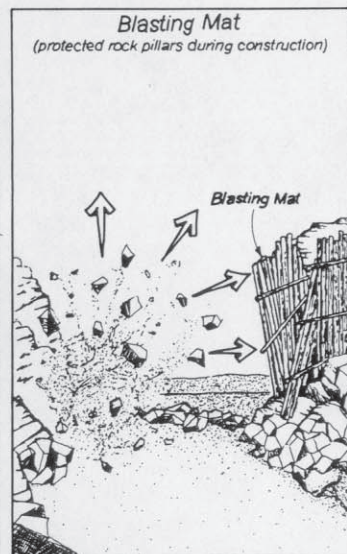
Choosing a Route



Drilling & Blasting



Excavation



Blasting Mat  
(protected rock pillars during construction)



Retaining Walls

DESIGNED BY: LUCAS DUPUIS, 2000  
NPS PARK ROADS  
RECORDING PROGRAM  
UNITED STATES DEPARTMENT OF THE INTERIOR

ESTES PARK VICINITY

ROCKY MOUNTAIN NATIONAL PARK ROADS - 1920/1932

LARIMER COUNTY

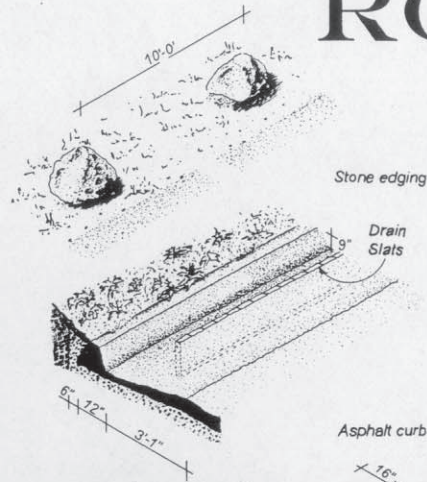
COLORADO

SHEET 6 OF 8

HISTORIC AMERICAN  
ENGINEERING RECORD  
CO-78

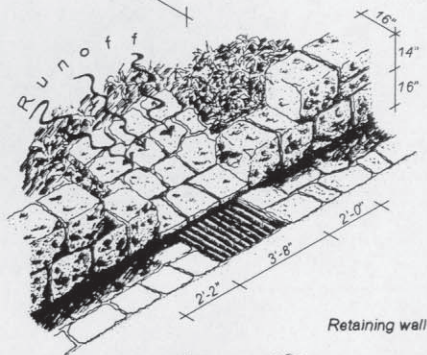
IF REPRODUCED PLEASE CREDIT: HISTORIC AMERICAN ENGINEERING RECORD, NATIONAL PARK SERVICE, NAME OF DELINEATOR, DATE OF THE DRAWING

# ROADSIDE EDGING

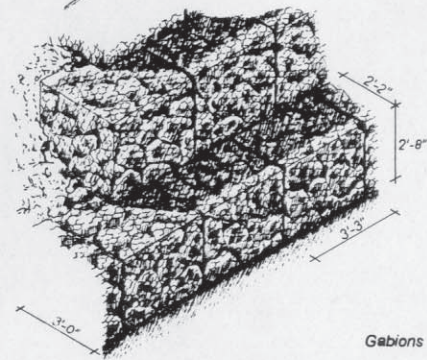


Stone edging

Drain Slats



Retaining wall

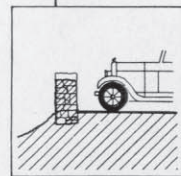


Gabions

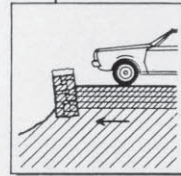
A variety of roadside treatments were employed along the edge of the Trail Ridge Road. The hand-laid rustic-style stone walls are the most extensively used form of roadside barrier. The original walls were "Type 3" crenellated parapet walls constructed from native stone chosen to harmonize with roadside outcrops. Over the years, some of these walls were partially buried as the road was repaved. Some of these sections are now being replaced with concrete core walls faced with native stone, much of it salvaged from the older walls. The park also has installed segments of precast concrete walls faced in artificial stone. These are used to stabilize

roadsides and to prevent uphill slopes from eroding, reducing the money and labor spent in ditch clearing and boulder removal. Wood poles resting on small cross logs are generally employed to discourage parking on narrow road sections; asphalt curbs flank other sections. Heavier log rails set into vertical posts formed roadside parapets on older road segments. Light A-frame pole fences are employed to delineate a separation between the roads and the wilderness beyond. On steep unstable sections prone to slides, gabions, rock-filled wire baskets, were used to stabilize the slopes.

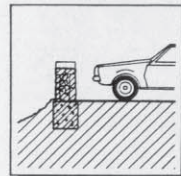
## WALL RECONSTRUCTION



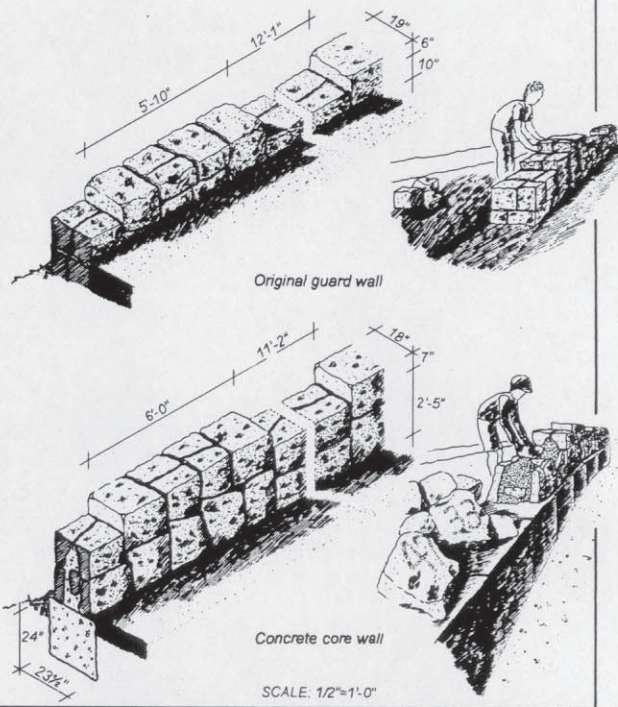
Original rustic style stone guard wall



Original guard wall

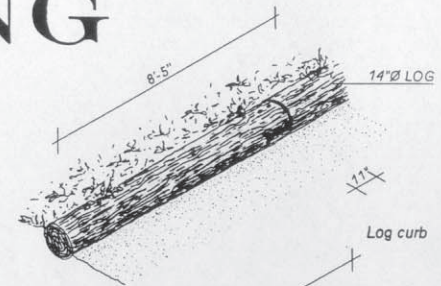


Replacement concrete core wall faced with native stone

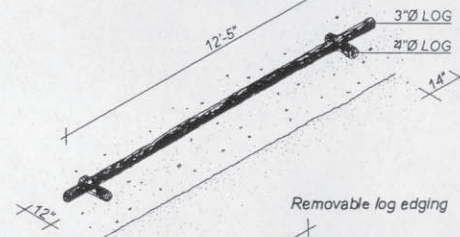


Concrete core wall

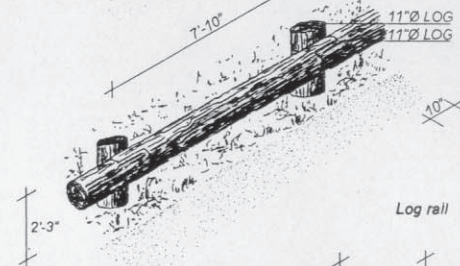
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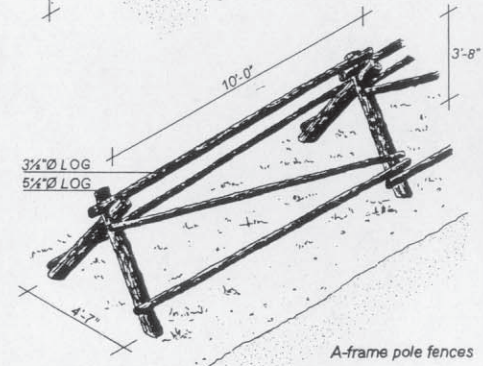
Log curb



Removable log edging



Log rail



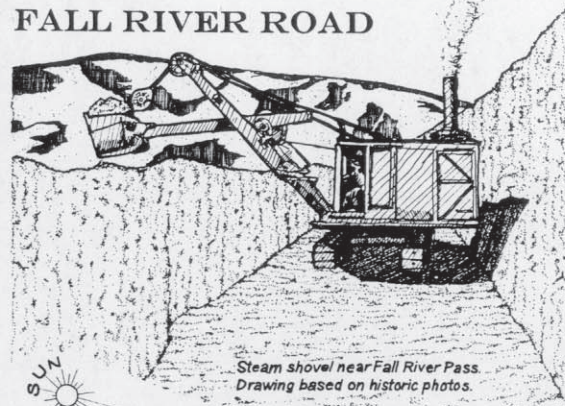
A-frame pole fences

# SNOW REMOVAL

Reaching heights of more than 12,000' above sea level, the roads in Rocky Mountain National Park are frequently buried deep in snow. The winter snowpack is often more than twenty feet deep, and twice that in areas buried by avalanches. Removing snow from the roads is a difficult and dangerous maintenance task.

Immediately after the Fall River Road was completed in 1920, park administrators realized that clearing snow would be a daunting task. The road climbed to Fall River Pass in a deep shaded valley, where avalanche chutes dumped deep accumulations of snow. The road was initially cleared with hand labor. Working conditions were severe. Cold temperatures combined with winds ranging up to more than 200 mph created extreme wind chill conditions. The high altitude sun caused snowblindness and severe sunburn. New avalanches would often cover cleared sections, forcing crews to repeat their work. Experiments were made with dynamiting and the use of blow torches, kerosene flares and carbide lamps, but it soon became clear that heavy equipment would be required. In 1925, the park acquired a specially designed steam shovel. In 1931 a "Sno-Go" rotary plow was placed in operation. Still, the tremendous snowpacks along the road were a major factor in deciding to construct the Trail Ridge Road on more open terrain. While the Trail Ridge Road was designed to pass through more open country with fewer places obstructed by heavy snow accumulation, the road climbed nearly a thousand feet higher than the Fall River Road and was also buried under deep snowpacks most years. By the time the road was completed in 1932, the park was using its new rotary plow. Even so, all old snow deeper than 45" had to be loosened with dynamite before it could be removed with machines. While heavier plows are now employed, opening the two park roads remains a tremendous and expensive undertaking. Despite periodic calls from tourist interests in nearby communities to keep the roads open year-round, crews face major challenges opening Trail Ridge Road by its target date of Memorial Day and Fall River Road by the Fourth of July.

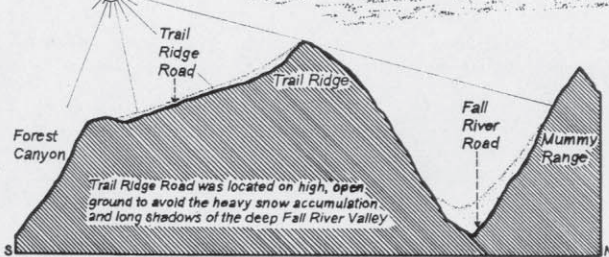
## FALL RIVER ROAD



Steam shovel near Fall River Pass.  
Drawing based on historic photos.



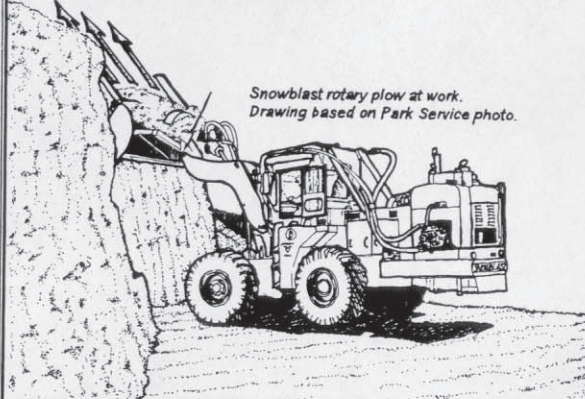
Clearing the road with hand labor.  
Drawing based on historic photo.



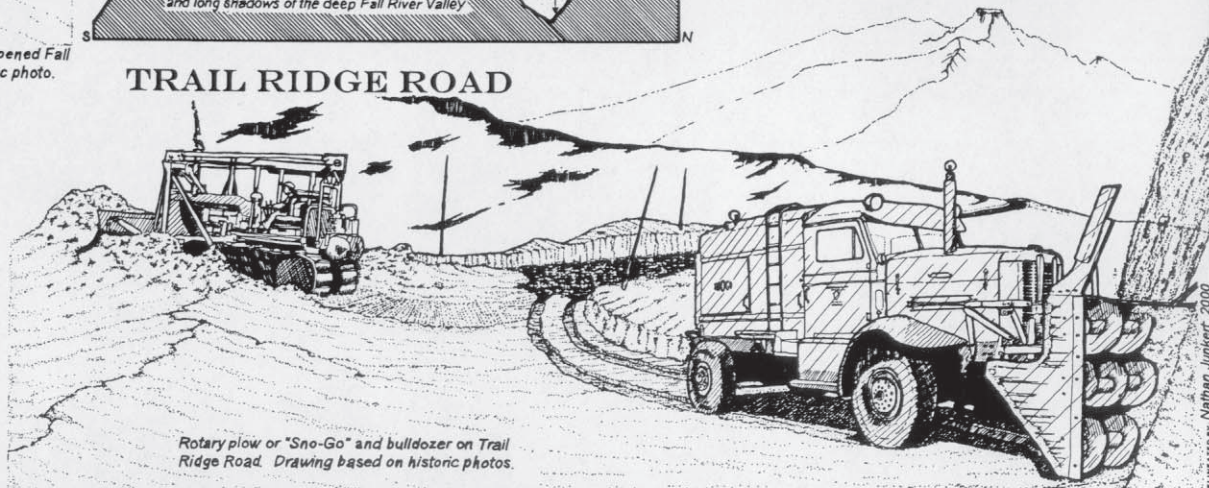
## TRAIL RIDGE ROAD



Tour group driving over the recently opened Fall River Road. Drawing based on historic photo.



Snowblast rotary plow at work.  
Drawing based on Park Service photo.



Rotary plow or "Sno-Go" and bulldozer on Trail Ridge Road. Drawing based on historic photos.